



# Understanding The Complexity Of Attention-Deficit/Hyperactivity Disorder

Associated Features, Comorbidities, And Unmet Needs

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# Objectives

1

Discuss the complex experience of individuals living with ADHD, including associated features and key comorbidities

2

Explore the current scientific understanding of ADHD neurobiology, particularly the roles of dopamine, norepinephrine, and serotonin

3

Examine the broader impact of ADHD and treatment gaps on functioning and quality of life

ADHD, attention-deficit/hyperactivity disorder.

# Prevalence Of ADHD In The United States



Approximately  
**15.5 million (~6.0%) adults** and  
**6.5 million (~10.5%) children and adolescents** in the United States  
are estimated to have ADHD<sup>1,2\*</sup>



ADHD manifests in childhood<sup>3,4</sup>



**~60%** of individuals diagnosed  
in childhood **continue to  
experience symptoms  
into adulthood**<sup>5</sup>

\*Adult prevalence was estimated using data from the NCHS RSS collected during October-November 2023.<sup>1</sup> Pediatric prevalence was estimated using data from the 2022 NSCH.<sup>2</sup>  
ADHD, attention-deficit/hyperactivity disorder; NCHS, National Center for Health Statistics; NSCH, National Survey of Children's Health; RSS, Rapid Surveys System.

#### References:

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5. Sibley MH, et al. *J Child Psychol Psychiatry*. 2017;58(6):655-662.

# Full Clinical Presentation Of ADHD

ADHD is a chronic neurodevelopmental disorder characterized not only by impaired levels of **inattention, hyperactivity, and/or impulsivity** but also several **associated features and comorbidities**<sup>1\*</sup>

## Core Symptoms (DSM-5-TR)

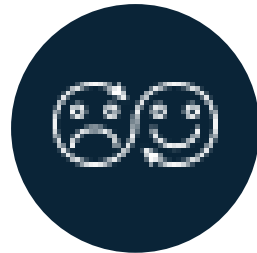


Inattention<sup>1</sup>



Hyperactivity/  
Impulsivity<sup>1</sup>

## Associated Features (DSM-5-TR)



Emotional  
dysregulation<sup>1</sup>

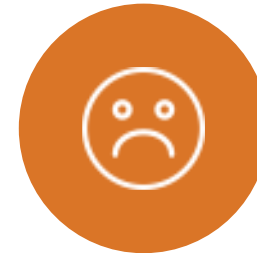


Executive  
function deficits<sup>1</sup>

## Major Comorbidities (DSM-5-TR)



Anxiety<sup>1,2</sup>



Depression<sup>1,2</sup>

\*"Complex" ADHD includes individuals presenting with one or more comorbidities.<sup>3</sup>

ADHD, attention-deficit/hyperactivity disorder; *DSM-5-TR*, *Diagnostic and Statistical Manual of Mental Disorders* (Fifth Edition, Text Revision).

### References:

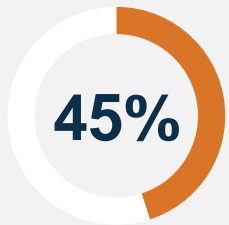
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2. Data and statistics on ADHD. Centers for Disease Control and Prevention. 2024. Accessed April 28, 2025. <https://www.cdc.gov/adhd/data/index.html>.
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# Associated Features: Emotional Dysregulation

Emotional dysregulation is the impaired ability to **control emotions** and **regulate emotional responses**<sup>1,2</sup>



Up to **45%** of children and up to **70%** of adults with ADHD have symptoms of emotional dysregulation<sup>3,4</sup>



of individuals treated with ADHD medications experience **residual symptoms** of emotional dysregulation<sup>5\*</sup>

Elevated levels of emotional dysregulation are associated with **lower overall quality of life**<sup>6</sup> and difficulties in domains including:



**Relationships**<sup>1,3</sup>



**Work**<sup>1,3</sup>



**School**<sup>1,3</sup>

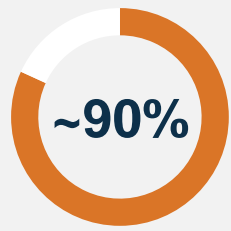
\*Based on a study of 585 adults with ADHD receiving pharmacological therapy (93.7% stimulants, 17.9% nonstimulants, 38.6% combination) reporting emotional impulsivity/mood lability in the past month.<sup>5</sup> ADHD, attention-deficit/hyperactivity disorder.

## References:

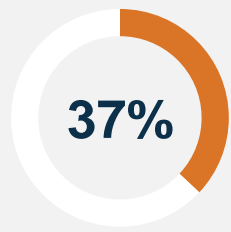
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# Associated Features: Impairments In Executive Function

Executive dysfunction is the impaired ability to initiate, organize, and monitor goal-directed behavior, involving deficits in working memory and cognitive flexibility<sup>1-3</sup>



Impairment in executive function may be **as common** as core symptoms in adults<sup>4,5</sup> and affects ~90% of children with ADHD<sup>6,\*</sup>



of individuals treated with a stimulant experience **residual symptoms** of executive dysfunction<sup>7†</sup>

**In individuals living with ADHD, executive dysfunction is associated with:**



**Lower socioeconomic status<sup>7</sup>**



**Higher unemployment<sup>7</sup>**



Adults



**Lower academic performance<sup>8</sup>**



**Impaired social functioning<sup>9</sup>**



Children and adolescents



\*Based on a study of 136 children with ADHD (n=55) or without ADHD (n=81).<sup>5</sup>  
†Based on a treatment study with a stimulant in adults with ADHD where, at Week 4, 62.7% (89/142) had a BADDS total score <50.<sup>7</sup>  
ADHD, attention-deficit/hyperactivity disorder.

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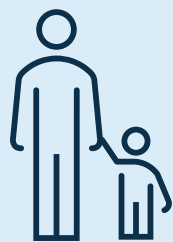
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# Common Comorbid Conditions: Anxiety And Depression

The overlapping symptoms between ADHD and other psychiatric disorders, such as anxiety and depression, can lead to misdiagnosis and delay effective treatment<sup>1</sup>



**Up to 50%**  
of individuals  
with ADHD have  
comorbid anxiety  
disorders and  
depression<sup>2-5</sup>

## Individuals with comorbid anxiety or depression have<sup>6,7</sup>:



Lower occupational achievements



Worse clinical presentation



Reduced quality of life

## Comorbid anxiety disorders are associated with<sup>6\*</sup>:



Increased rates of hospitalization and psychotic symptoms



More suicidal behaviors



Propensity for anger

\*Based on a study of 353 individuals with ADHD in a specialized psychiatric unit for the treatment of emotional dysregulation.<sup>6</sup> ADHD, attention-deficit/hyperactivity disorder.

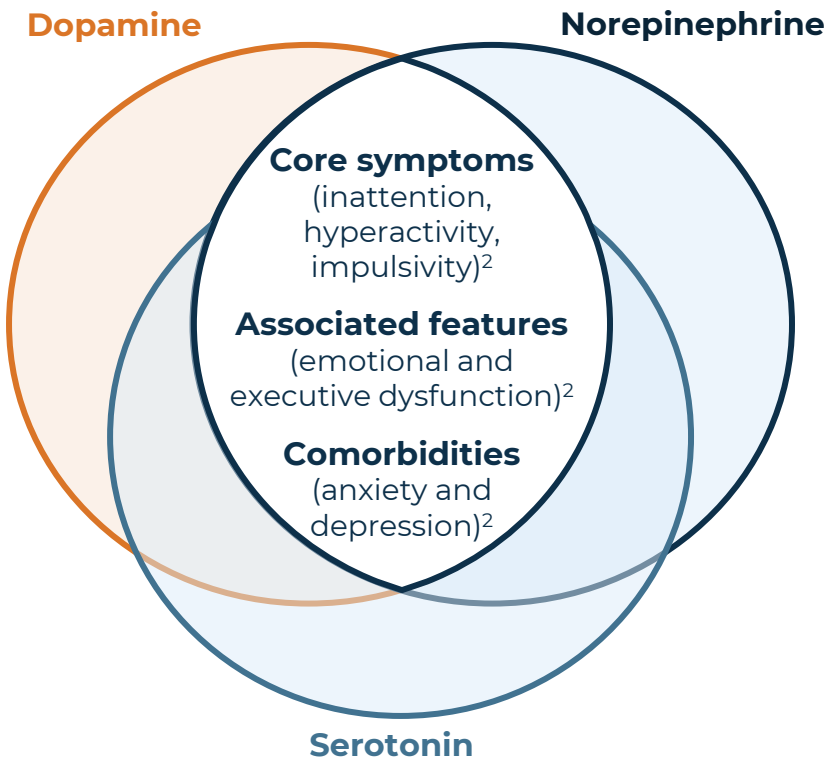
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# Pathophysiology Of ADHD

The interplay between norepinephrine, dopamine, and serotonin plays a critical role in ADHD neurobiology<sup>1</sup>



	Physiological functions
Dopamine <sup>3</sup>	Movement, mood, attention, learning and memory, and reward processing
Norepinephrine <sup>3</sup>	Attention, arousal, signal-to-noise processing, mood regulation, and stress response
Serotonin <sup>4</sup>	Mood, perception, appetite, aggression, anxiety, and reward processing

ADHD, attention-deficit/hyperactivity disorder.

References:

1.

Koirala S, et al. *Nat Rev Neurosci.* 2024;**25**(12):759-775.
2.

American Psychiatric Association. *Diagnostic and statistical manual of mental disorders.* 5th ed, text revision. American Psychiatric Association; 2022.
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Pourhamzeh M, et al. *Cell Mol Neurobiol.* 2022;**42**(6):1671-1692.

# Limitations Of Current ADHD Management: Residual Symptoms And Treatment-Related Adverse Effects



**Fewer than 30%**  
report **full satisfaction** with  
their current stimulant therapy<sup>1,\*</sup>

**Key challenges:**  
difficulties with driving, relationships,  
and financial insecurity

\*In a survey of adults with ADHD receiving treatment with stimulants.<sup>1</sup>  
ADHD, attention-deficit/hyperactivity disorder; US, United States.

#### References:

1. National Academies of Sciences, Engineering, and Medicine. Adult attention-deficit/hyperactivity disorder: diagnosis, treatment, and implications for drug development: proceedings of a workshop (2024). The National Academies Press; 2024.
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5. Faraone SV, et al. *Paediatr Drugs*. 2021;23(6):583-589.
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7. Schein J, et al. *J Med Econ*. 2024;27(1):653-662.



## Efficacy



Many individuals with ADHD continue to experience **residual symptoms**, including:



- Emotional dysregulation (45%)<sup>2,3</sup>
- Executive function deficits (37%)<sup>4</sup>



## Safety



**Burdensome treatment-related side effects** can contribute to poor adherence and negatively affect quality of life<sup>1,2</sup>

- 95% of adults in the US receiving treatment experience at least 1 symptom related to ADHD or adverse effects<sup>3</sup>
- 2/3 of individuals will **change treatment** within 12 months<sup>3,5,6</sup>



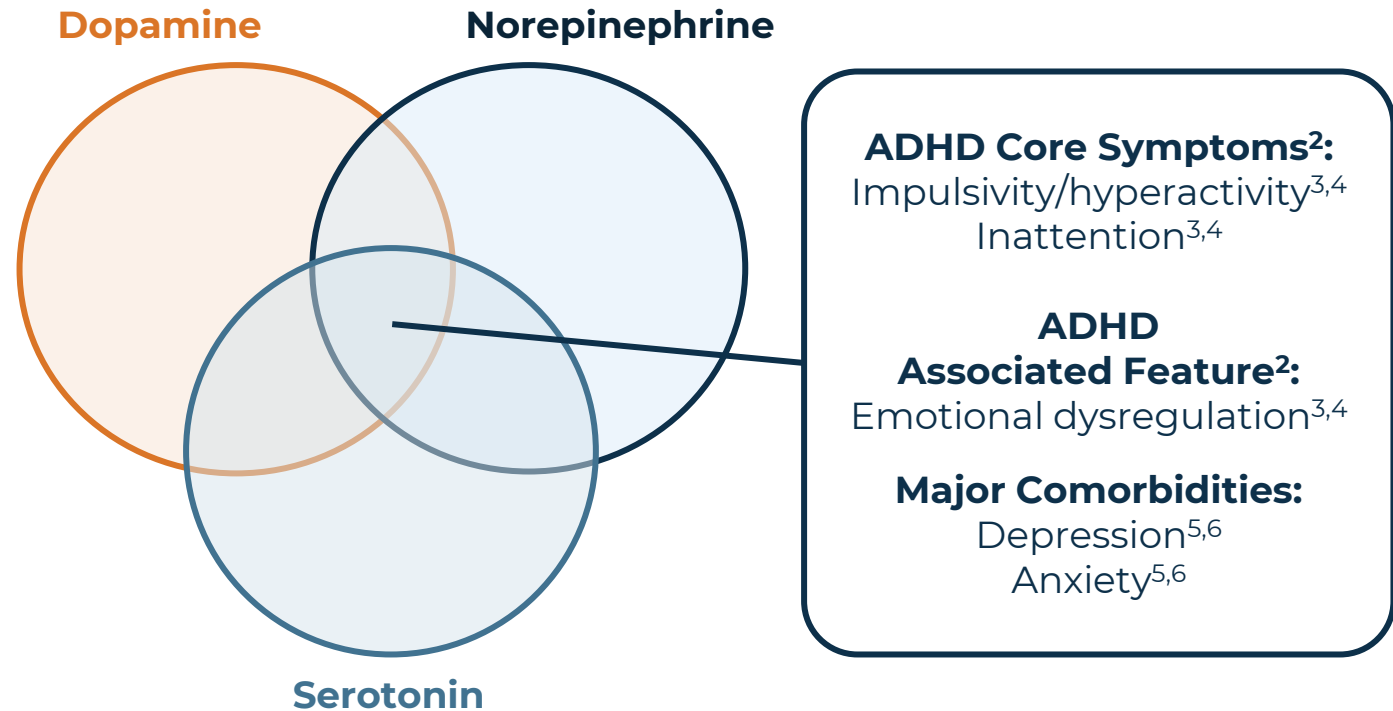
**Anxiety** may show lack of improvement or potential worsening<sup>1-3,7</sup>

# Integrative Approach to ADHD Treatment

There is a need for medication to address the complete clinical presentation of ADHD

Emerging evidence shows the interplay between monoamine neurotransmitters in ADHD pathophysiology highlights the need for an **integrative approach** to treatment<sup>1</sup>

**Current treatments** do not target **all aspects** of ADHD neurobiology and may not effectively address associated features and comorbidities



ADHD, attention-deficit/hyperactivity disorder.

## References:

1. Wang Y, et al. *Neurosci Lett*. 2021;760:136086.
2. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 5th ed, text revision. American Psychiatric Association; 2022.

3. Faraone SV, et al. *Nat Rev Dis Primers*. 2024;10(1):11.
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# Summary



ADHD is a common chronic disorder whose full clinical presentation includes not only core symptoms but also associated features and psychiatric comorbidities<sup>1</sup>



The interplay between norepinephrine, dopamine, and serotonin plays a critical role in the core symptoms, associated features, and common comorbidities of the disorder<sup>1-6</sup>



Many individuals treated for ADHD continue to experience residual symptoms and significant treatment-related adverse effects<sup>7-12</sup>

ADHD, attention-deficit/hyperactivity disorder.

## References:

1. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 5th ed, text revision. American Psychiatric Association; 2022.
2. Koirala S, et al. *Nat Rev Neurosci*. 2024;25(12):759-775.
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# Appendix



# Prevalence of ADHD in Canada



In Canada, the overall ADHD prevalence estimate across all provinces is **2.9% for adults** and **8.6% for children**<sup>1\*</sup>



ADHD manifests in childhood<sup>2,3</sup>



**~60%** of individuals diagnosed in childhood **continue to experience symptoms into adulthood**<sup>4</sup>

\*Based on a 2022 review of studies published between 2012 and 2022 examining the prevalence of ADHD in Canada.<sup>1</sup> Rates varied across multiple studies.<sup>1</sup>

ADHD, attention-deficit/hyperactivity disorder

## **References:**

1. Espinet SD, et al. *Brain Sci.* 2022;12(8):1051.
2. Øie M, et al. *J Atten Disord.* 2018;22(5):446-459.
3. Lapalme M, et al. *J Emot Behav Disord.* 2018;26(2):106-118.
4. Sibley MH, et al. *J Child Psychol Psychiatry.* 2017;58(6):655-662.